The University of Texas at TYLER
COLLEGE OF ENGINEERING

Department of Mechanical Engineering
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Uttyler.edu/engineering

MENG 4330 - Process Control
Course Syllabus

Semester / Year	Spring 2022
Catalog Description	The course focuses on the use of controls in the process industry. The development of process models will involve measurement of variables, controller types, and final elements. Design and evaluation of controllers in processes including thermal systems will be carried out. General instrumentation design and practice will be conducted.
Prerequisites	**MENG 4312 or EENG 4308**
Section number	030 & 040
Instructor name	Dr. M. A. Rafe Biswas
Contact info	Office: HEC A214 or via Zoom (details posted on Canvas) E-mail: mbiswas@uttyler.edu Phone & Zoom ID: 903 566 6115
Class Type/Location	030: Hybrid (Zoom synchronous and/or Face-to-face) / HEC A216 040: Hybrid (Zoom synchronous) / RBN 3038
Class Time	030 & 040: MW 6:00PM - 7:25PM
Office Hours	MTW 2:15 to 3:45 pm or By appointment
Credit Hours	3 (3 hours lecture and 0 hours laboratory per week).
Required Textbook	None
Optional References	Recommended textbooks (some available *via* library using patriots account) – - Chapter 8 Process control from Green, Don W., and Robert H. Perry. "Perry's chemical engineers' handbook." 8th Ed., McGraw-Hill Education (2007). - Chandra, Rames Panda, and T. Thyagarajan. *Introduction to Process Modelling Identification and Control for Engineers, An*, Alpha Science International, 2017. *ProQuest Ebook Central*, https://ebookcentral.proquest.com/lib/uttyler/detail.action?docID=5426842. - Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, and Francis J. Doyle, *Process Dynamics and Control*, 3rd Ed., John Wiley and Sons, New York (2010). Additional Material on Canvas: Websites, Class Handouts, Tutorials on MATLAB and Simulink by Mathworks, Inc.

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Additional requirements	MATLAB, Simulink & Simscape by MathWorks, Inc. (available through virtual desktop – one.uttyler.edu and IT support); Temperature Control using Arduino Kit
Evaluation Method	Grading: **Project** **50%** **Assignments, Class Participation and Conduct** **25%** **Exam** **25%**
Grading Policy / Scale	Letter grades Scale: A 90 – 100 B 80 – 89 C 70 – 79 D 60 – 69 F < 60 Grade appeal: grades can be appealed by meeting the instructor during office hours, but no later than a week after the grade has been given. Moreover, students may appeal the grade reduction to the instructor if valid excuse with documentation is provided. Note: your final semester grade is based on the 10-point scale. No curving or scaling will be applied even if you receive borderline grade such as 79.99.
Important events / dates	Census date: Jan 24 Exam 1: Jan 19 Scope Report: Jan 31 Exam 2: Feb 28 Mid Report: **March 28** Final Report & Exam (during Finals week): April 28 (Tentative)
Attendance / Makeup policy	1. Attendance is expected per university policy. Attendance of lectures may be regularly checked using Canvas. 2. Make-up exams or assignments if approved will be administered during finals week. 3. No email submission of assignment(s). All assignments MUST be submitted to Canvas for grading. 4. Student with SAR status should contact the UT Tyler Office of Student Accessibility and Resources for exam arrangements. 5. Any minor violation of the Student Behavior (see below) by a student will result in a full letter grade reduction for each incident and any single major violation such as cheating and plagiarism by a student will result in automatic failing grading in the course. **Additional policies amid COVID-19** Attendance of lectures, either by face-to-face or live Zoom synchronous, can be checked randomly throughout the semester using Canvas quizzes or assignments.
Course Learning	1. Ability to develop mathematical models and transfer functions of processes. 2. Analyze and model dynamic processes in time domain.

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<table>
<tr><td>Objectives / ABET & PEOs relation</td><td>3. Utilize computational tools to design and analyze different types of control systems.
4. Able to read and interpret block diagrams, and process and instrumentation diagrams.
5. Relate the use of control systems to real-world problems.</td></tr>
<tr><td>Tentative Topics</td><td>• Mathematical modeling of different processes includes thermal fluid systems
• Transfer Function and State-Space models
• Characteristic Dynamic Behavior and Analysis of Processes including empirical modeling
• Advanced Control architectures including Feedback and Feedforward control
• Control System Design, Tuning and Analysis
• Process and instrumentation diagram</td></tr>
<tr><td>Other</td><td>Note: Use the above email only or Canvas messaging, which is used as official mode of campus communication. If you call, please leave a voicemail with name and contact if call is not answered. Please allow instructor at least 24-48 hours to respond to your email/phone.

Tentative Course schedule:

<table>
<tr><th colspan="2">Week of</th><th>Major items Due on Canvas</th><th>Video/Reading Assignment</th></tr>
<tr><td>Jan</td><td>10</td><td>Welcome and Intro</td><td>Intro to Process Control/Review Syllabus, Laplace Transform & Transfer Functions</td></tr>
<tr><td></td><td>17</td><td>Exam 1 (Jan 19)</td><td>No lecture (Take home assignments will be announced on Canvas)</td></tr>
<tr><td></td><td>24</td><td></td><td>Dynamic modeling of thermal fluid energy systems</td></tr>
<tr><td></td><td>31</td><td>Scope Report</td><td>FODT/SODT order system characteristics</td></tr>
<tr><td>Feb</td><td>7</td><td></td><td>Higher order system characteristics</td></tr>
<tr><td></td><td>14</td><td></td><td>Empirical Model Development /System Identification/Work on Project</td></tr>
<tr><td></td><td>21</td><td></td><td>Control System Instrumentation</td></tr>
<tr><td></td><td>28</td><td>Exam 2</td><td>Feedback Control/Work on Project</td></tr>
<tr><td>Mar</td><td>7</td><td colspan="2">Spring Break - No Class</td></tr>
<tr><td></td><td>14</td><td></td><td>Closed Loop Control System Analysis</td></tr>
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		21	PID Controller Design and Tuning
		28	Progress Report — Review Topics
	Apr	5	Feedforward Control
		12	Enhanced/Combined Control Strategies
		19	Work on Project
		25	Final Report & Exam — Finals Week (No classes)

Evaluation activities

- Exam: There will be 3 Exams during the semester. Exam 1 is a review assignment that covers Differential Equations including Laplace Transform concepts. Exam 2 covers the material in first half of the semester. Final exam is comprehensive and related to the project. No late submission will be accepted and will result in automatic grade of zero. Make-up exam if approved by instructor will be administered during finals week.
- Project: There will be 3 video reports (voice over recorded slide presentation) during the semester. Each student will choose a complex thermal fluid energy system to model and control which they will present as Scope Report. Each student analyzes the system and simulate the system using MATLAB and Simulink® to then submit Midterm/Progress Report. Each student then develops the control architecture for given system and provide results for different operating (input/disturbance) conditions to then submit Final Report. *Each student has option to collaborate and present with a maximum of 5 students – completely optional and no peer evaluation will be considered*. Instructions on the report format/style, grading rubric form and checklist will be posted separately. No late submission will be accepted and will result in automatic grade of zero. Late submissions of assignments will result in 10% deduction from the graded score after each 24-hour period.
- Assignments, Class Participation and Conduct: Attendance and participation to lectures are expected per university policy. Check class and Canvas regularly for any announced assignments according to the topics covered in lectures. Questions involving knowledge covered in class can be checked if your work is shown to the instructor, but no solutions will be posted on Canvas. Come prepared to class by reviewing relevant material, taking notes, solving problems and participating in discussions, which are all expected. Late submissions of assignments will result in 10% deduction from the graded score after each 24-hour period.

Instructions on the oral/video report format/style, checklist and grading rubric form will be posted separately on Canvas. Figure 1 shows amount time that should be invested into the course weekly.

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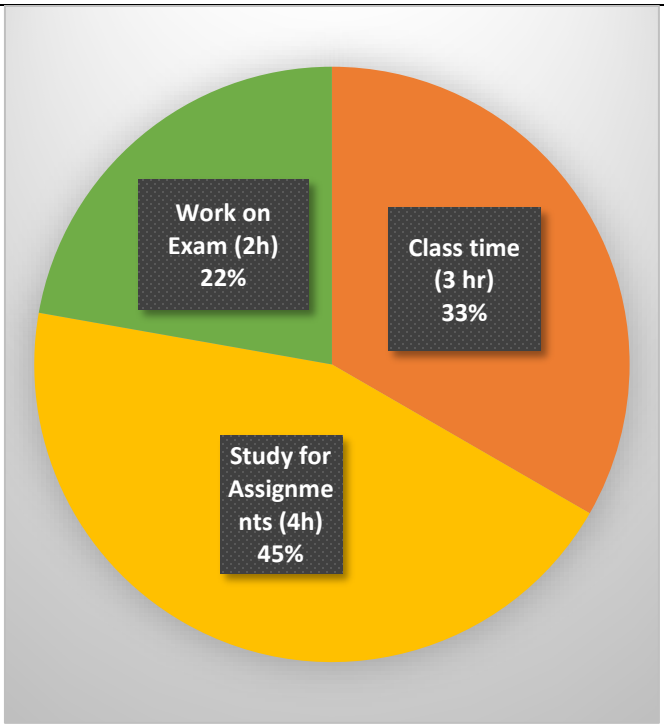

Figure 1. Weekly Invested Hours into the course

Recording of Class Sessions
Class sessions may be recorded by the instructor for use by students enrolled in this course. Recordings that contain personally identifiable information or other information subject to FERPA shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant students. Class recordings are reserved only for the use of students enrolled in the course and only for educational purposes. Course recordings should not be shared outside of the course in any form without express permission.

Your experience in this class is important to me. If you have already established accommodations with Student Accessibility Services, please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. If you have not yet established services through SAS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but are not limited to: mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to please visit the SAR webpage at http://www.uttyler.edu/disabilityservices or call 903.566.7079. SAR offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s), and SAR. It is important to University of Texas at Tyler to create inclusive and accessible learning environments consistent with federal and state law.

NOTE: The syllabus is subject to change during the course of semester as deemed necessary.

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University, College, and Department Policies:

1. **Modifications**

The instructor reserves the right to change this syllabus partially or fully at any point in time. Sufficient time and notice will be provided to the class before the activation of the changes.

2. **UT Tyler Honor Code**

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

3. **Student Standards of Academic Conduct**

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, or material which has been submitted within a different course without explicit approval of the instructor, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:

- copying from another student's test paper;
- using, during a test, materials not authorized by the person giving the test;
- failure to comply with instructions given by the person administering the test;
- possession during a test of materials, or devices and instruments allowing access to materials, which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes" as well as cell phones, to name a few. The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
- using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
- collaborating with or seeking aid from another student or person during a test or other assignment without explicit authorization;
- discussing the contents of an examination with another student who will take the examination;
- divulging the contents of an examination, for the purpose of preserving questions for use by another, or removing material from the exam location, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
- substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
- paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
- falsifying research data, laboratory reports, and/or other academic work offered for credit;
- taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
- misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

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ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.
iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.
iv. All written work that is submitted will be subject to review by plagiarism software.
v. Penalty for any related infractions will be decided at the discretion of the instructor including, but not limited to, granting of a failing grade in part or the course or in the entire course.

4. Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

5. Important Covid-19 Information for Classrooms and Laboratories

Students are required to wear face masks covering their nose and mouth, and follow social distancing guidelines, at all times in public settings (including classrooms and laboratories), as specified by Procedures for Fall 2020 Return to Normal Operations. The UT Tyler community of Patriots views adoption of these practices consistent with its Honor Code and a sign of good citizenship and respectful care of fellow classmates, faculty, and staff.

Students who are feeling ill or experiencing symptoms such as sneezing, coughing, or a higher than normal temperature will be excused from class and should stay at home and may join the class remotely. Students who have difficulty adhering to the Covid-19 safety policies for health reasons are also encouraged to join the class remotely. Students needing additional accommodations may contact the Office of Student Accessibility and Resources at University Center 3150, or call (903) 566-7079 or email saroffice@uttyler.edu.

6. Recording of Class Sessions

Class sessions may be recorded by the instructor for use by students enrolled in this course. Recordings that contain personally identifiable information or other information subject to FERPA shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant students. Class recordings are reserved only for the use of students enrolled in the course and only for educational purposes. Course recordings should not be shared outside of the course in any form without express permission.

7. Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

8. UT Tyler a Tobacco-Free University

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All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.
Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless
tobacco, snuff, chewing tobacco, and all other tobacco products.
There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support.
For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

9. Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.
Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.
The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms , requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

10. State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).
Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

11. Disability/Accessibility Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit

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https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

The University of Texas at Tyler has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Like so many things this Fall, the need for accommodations and the process for arranging them may be altered by the COVID-19 changes we are experiencing and the safety protocols currently in place. Students with disabilities who may need accommodation(s) in order to fully participate in this class are urged to contact the Student Accessibility and Resources Office (SAR) as soon as possible, to explore what arrangements need to be made to ensure access. During the Fall 2020 semester, SAR will be conducting all appointments via ZOOM. If you have a disability, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student Application. For more information, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices or call 903.566.7079.

12. Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

13. Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

14. Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

15. Emergency Exits and Evacuation

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

16. UT Tyler Resources for Students

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254)